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that the diminished force of gravity on *Mars* would render the work of excavating a ditch 70 feet deep equal to a terrestrial one of 26 feet, it was calculated that the canals would contain about 1,634,000 of our Suez Canals, and would require an army of 200,000,000 of men, working for 1000 of our years, for their construction. Assuming that the population varies with the surface, since the area of the earth is about $3\frac{1}{2}$ times greater than that of *Mars*, we should get a Martian population of about 409,000,000. All the adult males, and a large number of the women, must, therefore, have engaged in the great work.

“The writer supposed the ‘canals’ to be great fissures caused by the cracking of the surface in contraction due to cooling, the planet having reached a considerably more advanced stage in its life than the Earth.

“A slide having been shown, representing the general canal system as given by SCHIAPARELLI, the President (Mr. E. W. MAUNDER, of the Greenwich Observatory,) said he hoped that Mr. ORR’s statistical, but, nevertheless, amusing and instructive, paper might prove one more nail in the coffin of a very absurd idea, which had certainly got most undue currency—namely, that the canals on *Mars* could possibly be the work of human agents. The mere fact that the whole of the resources of one of the greatest nations in Europe had failed to dig a little ditch some 26 miles long, and, comparatively speaking, only a few feet wide, might, he thought, convince us that the people on *Mars*, supposing there were any, could scarcely excavate 80,000 or 100,000 miles of canals, 40 miles wide.”

CORRECTION TO HUSSEY’S LOG. TABLES.

Page 95: $\log. \sin. 33^\circ 44'$, should be 9.74455 in place of
9.74555. R. H. T.

THE ROSSI-FOREL SCALE OF EARTHQUAKE INTENSITY.

As a ready means of defining the intensity of a shock of earthquake from the ordinary descriptions of its effects, the ROSSI-FORTEL scale will be found convenient, and is reprinted from *Archives des Sciences Physiques et Naturelles*, Geneva, February, 1884, Vol. XI, page 148.

In discussing the reports of shocks which occurred between 1850 and 1887, Professor HOLDEN was led to make some addi-

tions to this scale for observations in California. These additions are italicized, and are in quotation-marks, being expressions actually used by newspapers, etc., in describing shocks whose intensity was otherwise known.

I.

Microseismic shocks recorded by a single seismograph, or by seismographs of the same model, but not putting seismographs of different patterns in motion; reported by experienced observers only.

II.

Shock recorded by several seismographs of different patterns; reported by a small number of persons who are at rest. "*A very light shock.*"

III.

Shock reported by a number of persons who are at rest; duration or direction noted. "*A shock;*" "*a light shock.*"

IV.

Shock reported by persons in motion; shaking of movable objects, doors, and windows; cracking of ceilings. "*Moderate;*" "*strong;*" "*sharp;*" (sometimes) "*light.*"

V.

Shock felt generally by every one; furniture shaken; some bells rung; some clocks stopped; some sleepers waked. "*Smart;*" "*strong;*" "*heavy;*" "*severe;*" "*sharp;*" "*quite violent.*"

VI.

General awakening of sleepers; general ringing of bells; swinging of chandeliers; stopping of clocks; visible swaying of trees; some persons run out of buildings; window-glass broken. "*Severe;*" "*very severe;*" "*violent.*"

VII.

Overturning of loose objects; fall of plaster; striking of church bells; general fright, without damage to buildings. "*Nausea felt;*" "*violent;*" "*very violent.*"

VIII.

Fall of chimneys; cracks in the walls of buildings.

IX.

Partial or total destruction of some buildings.

X.

Great disasters; overturning of rocks; fissures in the surface of the earth; mountain slides.

The following deductions relating to earthquake intensity are interesting in this connection, and are from *Bulletin* No. 95 of the U. S. Geological Survey, "Earthquakes in California in 1890 and 1891," by Professor HOLDEN:

If both the period, T , and the amplitude, a , of an earthquake wave are given, the maximum acceleration due to the impulse, which may be taken as a measure of the intensity or destructive effect of the shock, is given by the formula—

$$I = \frac{4\pi^2 a}{T^2}$$

in which the motion is assumed to be harmonic.

The relation between the intensity (I) of a shock, as determined by the formula above, and the numbers of the ROSSI-FOREL scale has been reduced from all available data up to 1888, and is given below in tabular form. It is, of course, a rough approximation only:

| ROSSI-FOREL Scale. | Intensity, Millimeters, per second. | Difference. |
|--------------------|--|-------------|
| I | 20 | ... |
| II | 40 | 20 |
| III | 60 | 20 |
| IV | 80 | 20 |
| V | 110 | 30 |
| VI | 150 | 40 |
| VII | 300 | 150 |
| VIII | 500 | 200 |
| IX | 1200 | 700 |

One of the objects of the earthquake observations on Mount Hamilton is to obtain data for correcting this table, so that the intensity of a shock, as defined mathematically by the formula

$$I = \frac{V^2}{a}$$

(where V is the maximum velocity of the vibrating particle), can be approximately inferred from the ordinary descriptions of its effects.

C. D. P.